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Cosmology with nonminimal kinetic coupling and a Higgs-like potential

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Abstract

© 2015 IOP Publishing Ltd and Sissa Medialab srl. We consider cosmological dynamics in the theory of gravity with the scalar field possessing the nonminimal kinetic coupling to curvature given as κGμνφ,μφ,ν, and the Higgs-like potential . Using the dynamical system method, we analyze stationary points, their stability, and all possible asymptotical regimes of the model under consideration. We show that the Higgs field with the kinetic coupling provides an existence of accelerated regimes of the Universe evolution. There are three possible cosmological scenarios with acceleration: (i) The late-time de Sitter epoch when the Hubble parameter tends to the constant value, as t , while the scalar field tends to zero, 0φ(t) , so that the Higgs potential reaches its local maximum . (ii) The Big Rip when H(t)~(t∗-t)-1 and φ(t)~(t∗-t)-2 as t t∗. (iii) The Little Rip when H(t)~ t1/2 and φ(t)~ t1/4 as t . Also, we derive modified slow-roll conditions for the Higgs field and demonstrate that they lead to the Little Rip scenario.

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Keywords

alternatives to inflation, cosmology of theories beyond the SM, dark energy theory, modified gravity